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Short Communication

Optimizing Pest Management Strategies for Chickpea (*Cicer arietinum*) by Implementing Trap Barrier Systems Against *Millardia meltada* in Faisalabad, Pakistan

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Key words
***M. meltada*, Chickpea, Agro-ecosystem, Trap barrier system, Economic loss, Rodent management**

ABSTRACT

This study presents the results of management measures of *Millardia meltada* (Soft-furred field rat) regarding a one-acre chickpea crop (*Cicer arietinum*) in Faisalabad, Pakistan. For this, two (one acre in dimensions) adjacently growing chickpea crops were selected. In the selected crop, the trap barrier system (TBS) was used to record weekly information regarding the soft-furred field rat's depredatory behaviors towards the chickpea. Incorporation of snap-traps, four at every corner of the chickpea field, was placed in the evening hours with suitable baiting materials. They were rechecked on the following morning for the entrapped species. Soft filed rat's depredations appear to have remained high (14.741±1.28) in the one-acre control plot, but there was a decrease (3.29±0.91) in the trap barrier phase (treated). The study results suggest the effectiveness of a trap barrier system against the soft-furred field rat. The rodents should be preferably managed using the environmentally safe and ecologically based rodent management measures (EBRM) as of the trap-barrier system for better and sustainable rodent management measures.

The soft-furred field rat (*Millardia meltada*) has been found in Southeast Asia in semi-arid and suitably wet environments (Roberts, 1997). They are restricted to mainly the Indo-Pak region appears to have a highly scarce dispersal in Pakistan and is confined to mainly the Northeastern Punjab and Southern Sindh. They also feed on post-harvest grains, therefore plowing after harvesting can reduce the amount of food for *M. meltada* (Smiet *et al*., 1980; Lathiya *et al*., 2003).

M. meltada had the highest reproduction rate and their burrows are simple, shallow, spherical, vertically oriented, 1 to 4 openings and easily recognizable from sympatric species' burrows. During an emergency, a hole with a thin layer of earth at the distal end is used (Pandey and Bhadauria, 2000; Nakamura *et al*., 2007; Neelanarayanan, 2008). The existence of canal-irrigated agro-system in Central Punjab for most of the year serves as a moderately stable habitat for *M. meltada* (Ali el al., 2003; Beg *et al*., 2010). Their hoarding behavior shows that these species migrate from one crop to another according to their choice (Pandey and Bhadauria, 2000).

In Pakistan, chickpea is the most widely grown rabi (irrigated) pulse, it ranked 2nd in area and 3rd in the world in pulse production (Abbas *et al*., 2017). Rodents endangered the production of chickpeas in the field as well as during storage. Factors such as different pests contribute to the quantitative losses of chickpeas (Pandey *et al*., 2016).

Therefore, it was hypothesized that the current research would reduce the effect of the soft furred field rat on the fully grown phase of chickpea crop by incorporating an ecologically based trap barrier system (TBS), with the ultimate goal of achieving superior yield.

Materials and methods

Faisalabad is situated at 31°25° in the North and

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73°04° in the South of Central Punjab, Pakistan. Wheat, maize, rice, pulses, fodders, sugarcane, sunflower, sorghum, mango, and mulberry are among the economically major agricultural and horticultural crops grown in this region. Before British rulers for the promotion of agriculture and after the division of subcontinent, numerous trees, have been planted near the rest canal houses in Punjab. Over the last multiple decades, the plantation provide shelter, where faunal variety flourishes under proper oversight (Ahmad *et al*., 2012; Beg *et al*., 2010).

This study evaluated the damage pattern of soft furred field rats (*M. meltada*) with the inclusion of snap-traps in a TBS in an acre Chickpea crop at the main campus of the University of Agriculture, Faisalabad. The trial was prolonged for a length of four months (16 weeks). Eight of them were preserved as control duplicates, while the other eight were barrier treatment repeats. An initial survey in the field was conducted and it is identified that *Salmalia malabarica, Syzygium cumini, Morus alba, Ficus bengalensis, Dalbergia sissoo Roxb, Azadirachta indica A.,* and *Albizia lebbeck* are dominant and co-dominant trees present in the field.

The soft furred field rat (*M. meltada*) populations was observed using snap-traps. Fine sheets of polyethylene were fastened around the chickpea crop at a height of 5 cm above the ground. To ensure tensile strength, wooden bamboo was put up at similar distances (40 cm) from one another. For the entering of rodents, four small outlets were deliberately left near the four corners of the field.

In order to accurately interpret the control and treat replicate findings, the dataset underwent statistical analysis on a micro-computer utilizing descriptive statistics, specifically employing ANOVA test (Steel *et al*., 1997).

Results

The current research's results demonstrated that the soft-furred field rat showed boosted food preference for the mature stage of the chickpea crop in the uncovered parts (12.428±1.37), with increased foraging patterns, as compared to the barrier-induced situation (2.43±1.49) whereas the proportions of *M. meltada* damaged decreased significantly (Table I). Due to the lack of any inhibition encountered by this rodent pest, it was revealed that *M. meltada* extended fairly intensive depredatory profiles for the chickpea crop throughout all the tested trap nights; however, in the trap barrier-induced circumstances a reduced injury profile was recorded describing the effectiveness of the trap-barrier system. The current investigations demonstrated to be useful point displays for the efficiency of TBS to reduce soft furred field rat invasions on chickpea at all development phases, but with increased intensity during the blooming period, which lead to maximal capture, the implementation of an ecologically based TBS lingered a vital safety component for the crop.

Table I. Comparative analysis of *M. meltada* captures in control and treated conditions of irrigated farmland in Faisalabad, Pakistan.

Trap nights	*M. meltada* captured with trap barrier system (control)	*M. meltada* captured without trap barrier system (treated)
1	2.43±1.49	12.428±1.37
2	2.14±2.003	13.1428±1.38
3	3.99±0.40	15.714±1.38
4	2.28±1.02	14.428±1.2
5	4.71±1.27	13.428±1.2
6	3.14±0.24	14.714±1.31
7	2.71±1.01	14.857±1.14
8	2.25±0.03	15.571±1.40
9	4.81±1.20	12.428±1.38
10	2.43±1.43	14.857±1.18
11	4.14±0.10	13.857±1.19
12	3.71±0.53	13.285±1.33
13	3.4±1.35	15.428±1.26
14	4.11±1.10	18.285±1.36
15	2.57±0.33	14.571±1.24
16	3.85±1.19	18.857±1.14
Overall	3.29±0.91	14.741±1.28

Discussion

The rodents are widespread in Pakistan and are a severe agricultural problem, cause 10% to 50% damage all over the country (Khan, 2013: Mosvi *et al*., 2020). The fact that the TBS probes are ecologically acceptable and, has been experimentally proved in several studies like the work of Brown *et al*. (2006) and Aplin and Ford (2014).The TBS is an important mechanism for crop protection because it creates a barrier-like shield. This has been witnessed in the chickpea field, where the TBS has effectively decreased daily rat catches. A recent study has shown that TBSs are effective in suppressing rodent populations while having no negative impacts on agricultural systems (Pujiastuti *et al*., 2018).

Furthermore, the trap barrier method works by erecting a physical barrier that keeps rats out of the crops. This barrier works as a protective shield, which significantly decreases rodent population damage. The TBS has been shown to be a profitable and effective way of rodent population suppression that does not jeopardize the sustainability of farming operations.

Conclusion

In Punjab, Pakistan's irrigated agro-ecosystem, rodents thrive due to factors such as moisture, abundant food resources, and minimal crop management measures, which contribute to their population growth. TBS is environment friendly and ecologically based technique offers more reliable and safe control programs for rodent management. Therefore, more emphasis is required to be laid on the adoption of environmentally safe and sound management methods with likely better output of crops and without serious impact on the ecosystem sustainability. These methods will not only increase chickpea yields but will also help to ensure the sustainability of agriculture in Pakistan.

DECLARATIONS

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Generative AI and AI assisted technology statement

The authors declare that no generative AI and AI assisted technology was used in the creation of this manuscript.

Statement of conflict of interest

The authors have declared no conflict of interest.

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